



CO₂ Reuse through Underground Storage

Update on the Dutch CO₂ storage demonstration project

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cleanfuels.novem.nl

www.crust.nl

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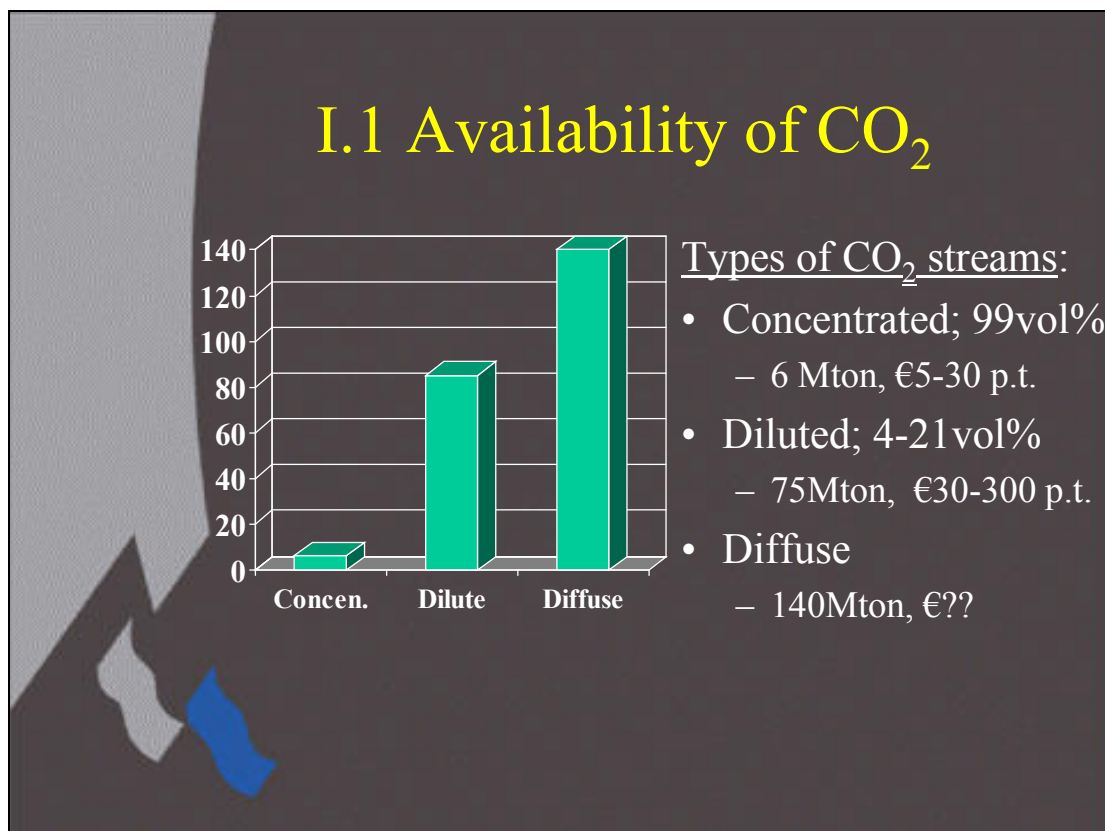


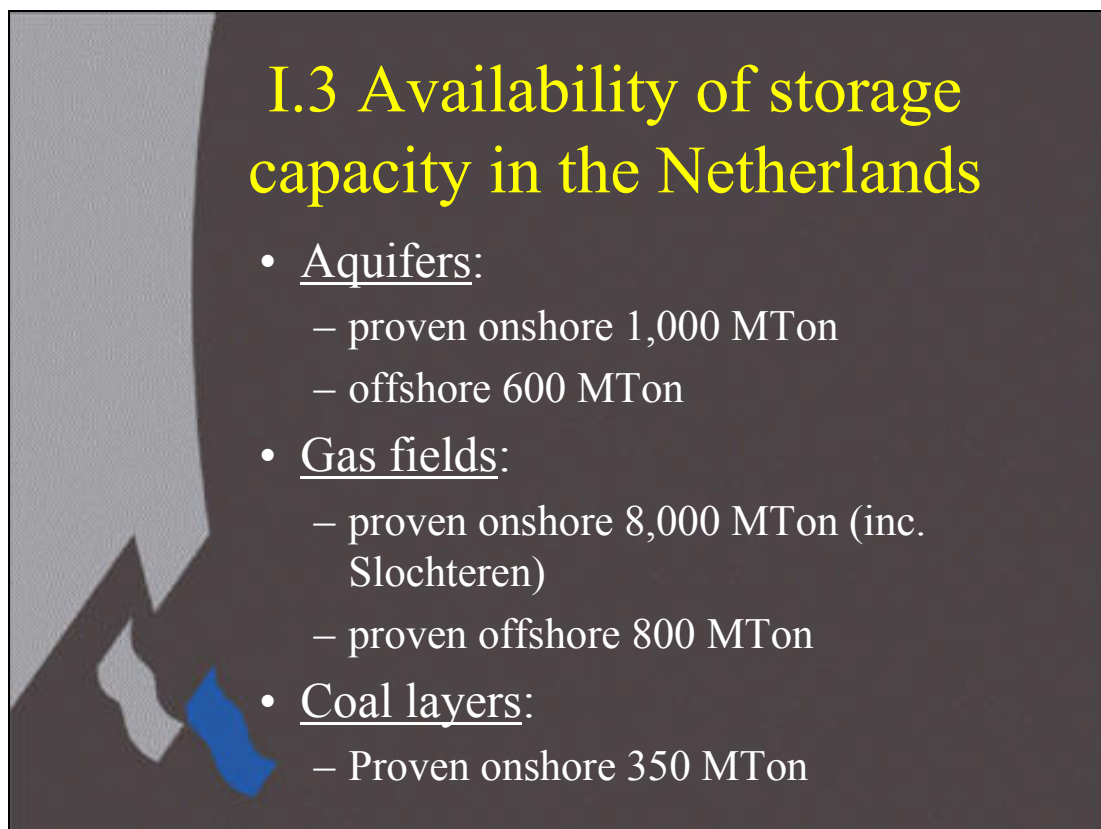
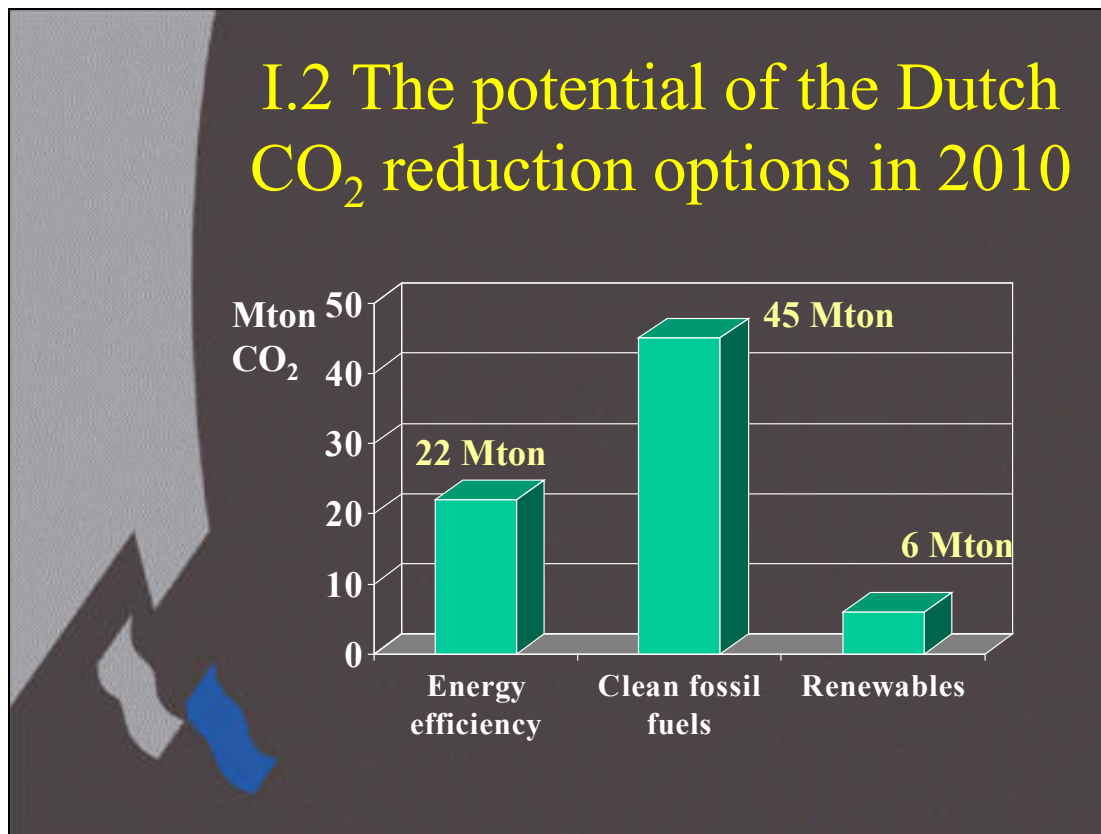
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Part I, Clean Fossil Fuels Inventory

- Inventory is structured by three energy systems:
 - Power & Heat demand
 - New Gas demand
 - Transport fuel demand
- Conclusions of the inventory:
 - Enough usable CO₂ available
 - Enough CO₂ reduction options available
 - Enough storage capacity available





I.4 Technical challenges

- Preconditions for the introduction of CFF state of the art technologies are:
 - Cost reduction, 50 %
 - Reduction energy consumption, 50%
- Development of new technologies:
 - New concepts (ZEPP, etc.)
 - Break-through techn. (membranes, etc.)
- International cooperation is a necessity for the Netherlands

Part II, The CRUST-project

- *Market* inventory (2001)
- *Legal* inventory (2001)
- *Monitoring and safety* study (2002)
- Two *feasibility* studies (2002)
- *Social* aspects inventory (2001-2002)
- *Tendering* for demonstration (2003)

Brochures of the above available: (i) give business card
(ii) <http://www.crust.nl> or (iii) p.stollwerk@novem.nl

II.1a Feasibility Studies NAM

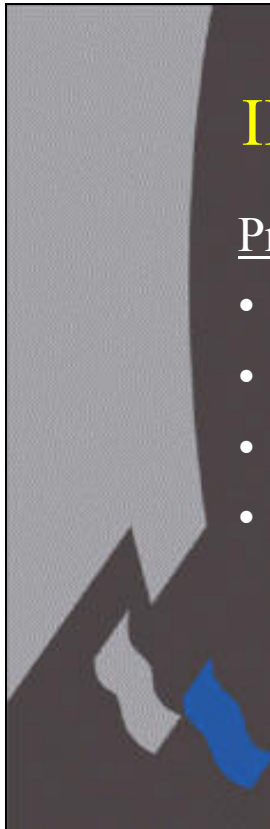
Characteristics:

- Injection in abandoned onshore gas field, capacity more than 3 Mt
- Project outline 0.5Mton CO₂ p.a.
- Dry CO₂ stream, Shell Pernis 99vol%
- Existing pipeline 30-40 bar, 16 km
 - Compression in Pernis and De Lier
- Reuse:
 - Greenhouses for reuse available
 - EGR no option, hopefully in the future

II.1b Feasibility Studies NAM

Identified issues:


- Risks w.r.t. transportation of CO₂
- Risks w.r.t. subsurface storage:
 - diffusion in wells 20cm/100 years
 - reservoir structure, possible interference with an aquifer
- Public awareness is growing
- Long term liability is of concern
- License to operate is important
- Communication with stakeholders

A small map of Mexico is located in the bottom left corner of the slide, with the country highlighted in blue against a dark background.

II.1c Feasibility Studies NAM

Preconditions for success:

- Concentrated CO₂ stream for free
- Pipelines available at low costs
- Injection location is available
- Revenues from greenhouses optional

A small map of Mexico is located in the bottom left corner of the slide, with the country highlighted in blue against a dark background.

II.2a Feasibility study Gaz de France (GDF)


- Offshore re-injection of CO₂
- Project outline:
 - 1st phase: 0,02Mton p.a.
 - 2nd phase: 0,5Mton p.a.
- Making use of available facilities:
 - Platform, scrubbing equipment, wells
 - Natural gas with 13% CO₂
- Not available: compression unit

II.2b Feasibility study GDF

- Legal aspects:
 - No problems expected
 - Ownership of injected CO₂
- Social aspects:
 - Communication towards stakeholders in to create acceptance


II.3 Economics Nam & GdF

	Onshore NAM	Offshore GdF
CAPEX	€45 mln	€10 mln
OPEX per annum	€6 mln	€1.4 mln
per ton CO ₂	€45	€5-8



II.4a Monitoring & Safety

- Monitoring aspects:
 - *Surface:*
 - State of the art technology
 - Pressure control system important
 - Timeframe: 25-50 years after abandonment
 - *Subsurface:*
 - Monitoring techniques depend on design of facility
 - Time lapse seismic in combination with wells observation
 - Timeframe: 75-125 years after abandonment



II.4b Monitoring & Safety

- Safety regulations:
 - CO₂ is a non-hazardous substance
 - Hazards of Major Accidents Decree does not apply
 - CO₂ is no waste aboveground
 - CO₂ is seen as a waste underground
- Quantitative risk assessment (EIS)
- Adopt rules for UGS
- Deploy potential of seismic monitoring techniques

II.5 Tendering the Demonstration

- European tender opened E/EP/RE/03010009
- Until 16 May 2003
- €3mln (10 % own financing)
- Onshore and/or offshore
- Start 2004, preliminary report within 2 or 3 years

III. Summing-up

- Enough usable CO₂ available (NL)
- Enough storage capacity available (NL)
- Tender open, storage projects identified:
 - 0,5Mton p.a. onshore storage €45 per ton
 - 0,5Mton p.a. offshore storage €5-8 per ton
- Legal blank spots identified
- Create acceptance with communication
- Risks are low, no real safety concerns
- Development monitoring system